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Instructions for use

Occurrence of a Commensal Hydroid *Eugymnanthea inquilina* Palombi from Japan

By

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(With 7 Text-figures)

During the investigations on the commensal hydroids associated with bivalve molluscs, an unrecorded hydroid from Japanese waters belonging to the genus *Eugymnanthea* was found inside the mussel, *Mytilus coruscus*, collected from Shimoda, Shizuoka Prefecture, Japan. Up to the present, two hydroids commensal with bivalves, *Ostreohydra japonica* Yamada, 1950 and *Eutima cirrhifera* (Kakinuma, 1964), have been known from Japanese waters (see Yamada, 1950; Kakinuma, 1964; Uchida, 1964; Kubota, 1978), and the present species is recorded here as the third one. The description of the present species and the morphological comparison with other related ones are given in this paper.

Material

A number of mussels, which aggregated densely and were attached to buoies or ropes, were collected from Nabeta Bay, Shimoda, within the depth of one meter on August 23 and 25, 1977, when the water temperature was 22°C. Out of the mussels examined (shell length: 1.2–5.3–9.8 cm, 1.6, 178*), only three mussels harbored the commensal polyp and the polyp in two of the mussels already bore medusa-bud which was liberated soon as medusa in the laboratory at Shimoda. On the other hand, several dozens of mussels which were already collected from the same habitat by the members of the Shimoda Marine Research Center (shell length: 2.2–7.0–9.9 cm, 1.9, 74) were kindly given to the author, but no polyps were unfortunately found in them and consequently the frequency of association of polyp with mussel is very low, showing only 1.2%. It is noticeable that the mussels harboring the polyp were ones of relatively smaller size.

The figures except for Fig. 4 and Fig. 5, 1, 2, 4 were made on the living specimens, and Figs. 1, 2, 5, 7 were made with the aid of a drawing apparatus.

* All the measurements in this paper were made on the living specimens, and are shown in the order: minimum-mean-maximum value, standard deviation, and the number of specimens examined.

Description of Polyp

The polyps with medusa-buds were picked up from a mussel of 4.4 cm in shell length, and their various body portions were measured in well-extended conditions soon after the host mussel was taken from the sea. The measurements are as follows:

Length of polyp from hypostome to pedal disk: 0.68–1.16–1.52 mm, 0.24, 18

Maximum width of hydrocaulus: 0.10–0.13–0.16 mm, 0.02, 18

Number of tentacles: 22–24.8–27, 2.0, 8

Position of medusa-bud*: 0.27–0.37–0.48, 0.05, 16

When these polyps were measured, the size (length \times maximum width) of their medusa-buds was 0.17–0.31–0.44, 0.08×0.09 –0.19–0.32 mm, 0.07, 18.

It is noticed that all the medusae liberated from the polyps which were associated with this mussel were female (cf. Description of Medusa).

Besides these polyps examined, the tiny polyps without medusa-bud were also picked up from the same mussel and their body portions were measured. Their measurements are:

Length of polyp from hypostome to pedal disk: 0.10–0.41–0.60 mm, 0.13, 11

Maximum width of hydrocaulus: 0.04–0.08–0.13 mm, 0.03, 11

Number of tentacles: 12–15.8–20, 2.8, 10

It is noted that the pedal disk of some of these tiny polyps was indistinct. Some of the polyps in culture could re-attach to the bottom of polystyrene vessels.

The external morphology of the present polyp closely resembles that of the polyp of *Eutima cirrhiifera* from Japan (see Kubota, 1978, p. 128, 1. 2–10), though the size of the former is smaller and the position of medusa-bud on hydrocaulus is upper than the latter.

The developmental process of a medusa-bud (Figs. 1–3) was observed in one (male) polyp which was carried back from Shimoda to the laboratory at Sapporo, Hokkaido, keeping it cool in icebox. This polyp was kept in a small polystyrene container filled with the filtered sea water supplied from Oshoro near Sapporo, and fed with newly hatched *Artemia* nauplii. Under the constant water temperature of $18 \pm 2^\circ\text{C}$, a small medusa-bud (Fig. 1, 1) developed day by day and the gonads were completely formed within two weeks (Fig. 2, 1–9), though the medusa-bud was not detached from the polyp and was reduced considerably on the 15th day (Fig. 2, 10, 11)**. Then it was kept under higher temperature (about 23°C of room temperature), and three medusa-buds of different growths were successively produced on the lower part of hydrocaulus below the former bud (Fig. 2, 11, 12; Fig. 3, 1), and one of them was liberated on the 23rd day (Fig. 1, 2; Fig. 3, 2). Further development of the other medusa-buds was not observed. It is noted

* Length between position of stalk of medusa-bud and lower end of hydrocaulus / length of polyp excluding pedal disk.

** Similar phenomenon was also observed in *Eugymnanthea inquilina* from Italy (see Palombi, 1935; Uchida, 1964).

that throughout this process the hydranth was not reduced and the number of tentacles of polyp (25) did not change.

On the other hand, from the two mussels all the polyps were picked up and their number was counted after they were fixed in a preservative (formalin) at Shimoda. In all the parts in both sides of the mantle cavity, 574 polyps were found in the mussel of 4.4 cm in shell length and 669 polyps were in the mussel of 3.4 cm, including the number of polyps for the use of measurements and further culture.

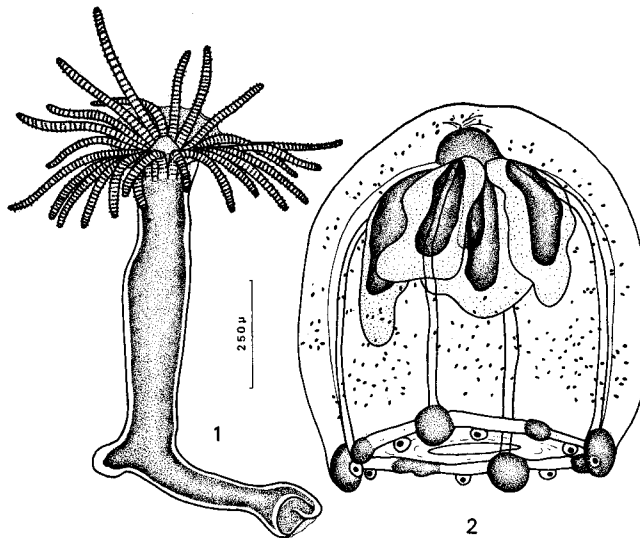


Fig. 1. The polyp with a very young medusa-bud (1) and its newly liberated medusa (2), specimen 1 (♂).

They were attached to the body-surface of the mantle, labial palp, gill, foot, and the other parts; and more than a half of them were found on the mantle, 55% in the former mussel and 68% in the latter. The polyps with medusa-buds only were found in a frequency of 35% in the former mussel and 50% in the latter, in which most of the polyps bore only one medusa-bud (Fig. 4, 1), while two medusa-buds of different growths were produced at the same time in eight specimens found in the latter mussel (Fig. 4, 2). The upper part of hydranth was not reduced during the development of the medusa-bud in most of these specimens, while the reduction barely occurred in one specimen in the former mussel and seven in the latter (Fig. 4, 3). The polyps with a small polyp which jointed by a common pedal disk were very few in number; 12 specimens in the former mussel and four in the latter, among which a polyp bearing a medusa-bud was found (Fig. 4, 4) in three specimens in the former and two in the latter. Furthermore, in the latter mussel, eight double-headed polyps were found on the mantle (Fig. 4, 5), out of them four possessed

medusa-buds and others not; and a polyp which branched near the pedal disk were found on the gill, and each zooid possessed medusa-bud (Fig. 4, 6). The pedal disk with a small knob was found in both the mussels; four in the former and three in the latter mussel. All these preserved polyps counted were small and did not

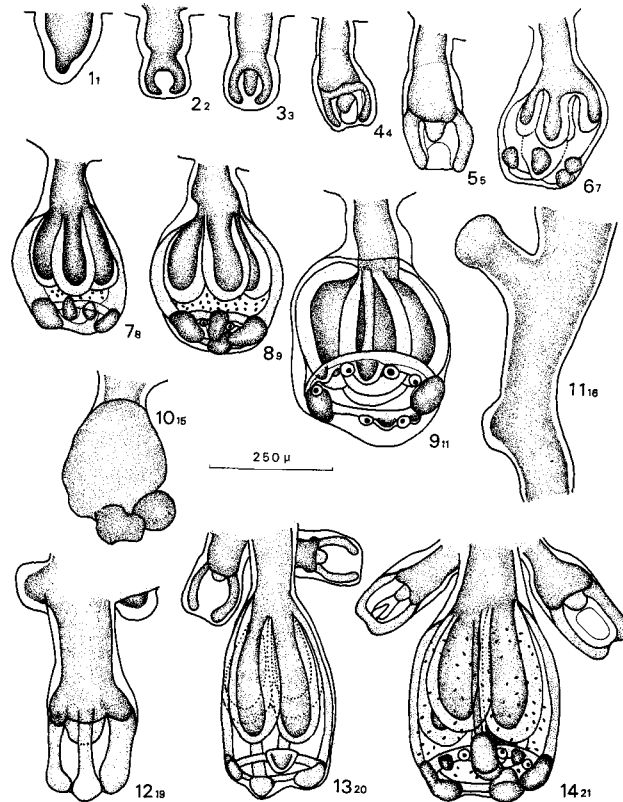


Fig. 2. The development of medusa-bud at low temperature (1-10) and that at high temperature (11-14). The small numerals on the right indicate the days of culture, specimen 1 (♂).

exceed the above-described measurements of polyps with medusa-buds. It is noted that a small number of polyps were found in another mussel of 4.3 cm in shell length, and they possessed no buds and were attached to the mantle of the right-hand of the mantle cavity.

The polyp is usually dark brown and sometimes orange or olive in color.

Description of Medusa

As was mentioned above, a number of medusa-buds were already ripe for liberation when the two host mussels described above were taken from the sea, and only female medusae were liberated exclusively in one mussel and male ones in the other.

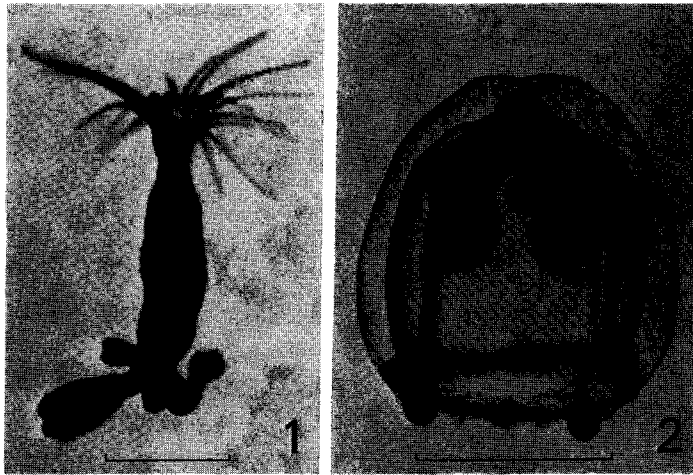


Fig. 3. The polyp with three medusa-buds of different growths after 20 days culture from the state of polyp as is shown in Fig. 2, 1, the polyp swallowed some *Artemia* nauplii (1); and its newly liberated medusa (2), specimen 1 (♂). The scale bar is 500 μ in length.

The medusa is small and the umbrellar width is a little larger than height, but one male specimen obtained from a cultured polyp is larger than height (Fig. 1, 2; Fig. 3, 2; Fig. 5; cf. Uchida, 1964: p. 105). The external morphology of the present medusa is simple. Despite of the small size, the newly liberated medusa already possessed mature gonads on the radial canals just near the stomach. The gonad did not extend along the radial canal but was suspended in the subumbrellar cavity as a sausage-like shape. The medusa possessed a considerably reduced, small manubrium on the center of the subumbrella; and four to eight statocysts each containing one statolith, four to eight small marginal warts without tentacles or cirri were present at the umbrellar margin; and on the whole surface of the exumbrella numerous nematocysts were strewed. In some specimens a small concavity was found at the apex of the umbrella to which a remnant of polyp or a polyp was attached and a short conical protrusion was extended into the jelly. The measurements of various body portions of the medusa in 15 female specimens and 11 male ones are as follows (measured in side view except for GW which was measured in aboral view):

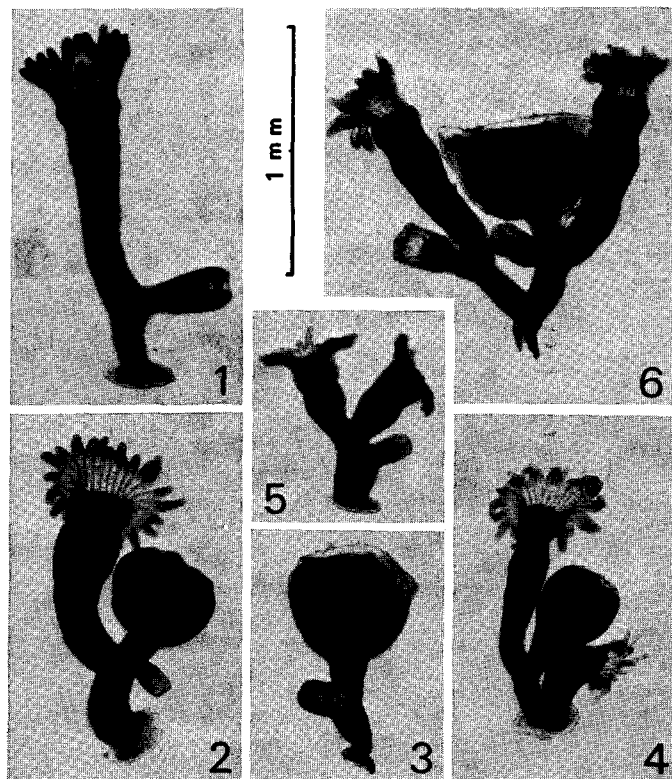


Fig. 4. The polyps in various morphological conditions (details shown in text). 1-3, 5, 6: specimens found in a mussel of 3.4 cm shell length; 4: specimen found in a mussel of 4.4 cm; specimens 2-7.

Maximum width of umbrella (W): ♀, 0.80-0.96-1.24 mm, 0.12; ♂, 0.78-0.85-0.92 mm, 0.05

Height of umbrella (H): ♀, 0.56-0.68-0.80 mm, 0.08; ♂, 0.60-0.71-0.76 mm, 0.05

Thickness of jelly at the apex of umbrella (J): ♀, 0.07-0.12-0.20 mm, 0.04; ♂, 0.08-0.10-0.12 mm, 0.02

Width of stomach (S): ♀, 0.12-0.13-0.20 mm, 0.02; ♂, 0.10-0.11-0.12 mm, 0.01

Length of manubrium (ML): ♀, 0.05-0.12-0.16 mm, 0.03; ♂, 0.08-0.11-0.16 mm, 0.02

Maximum width of manubrium (MW): ♀, 0.04-0.04-0.04 mm, 0.00; ♂, 0.04-0.05-0.06 mm, 0.01

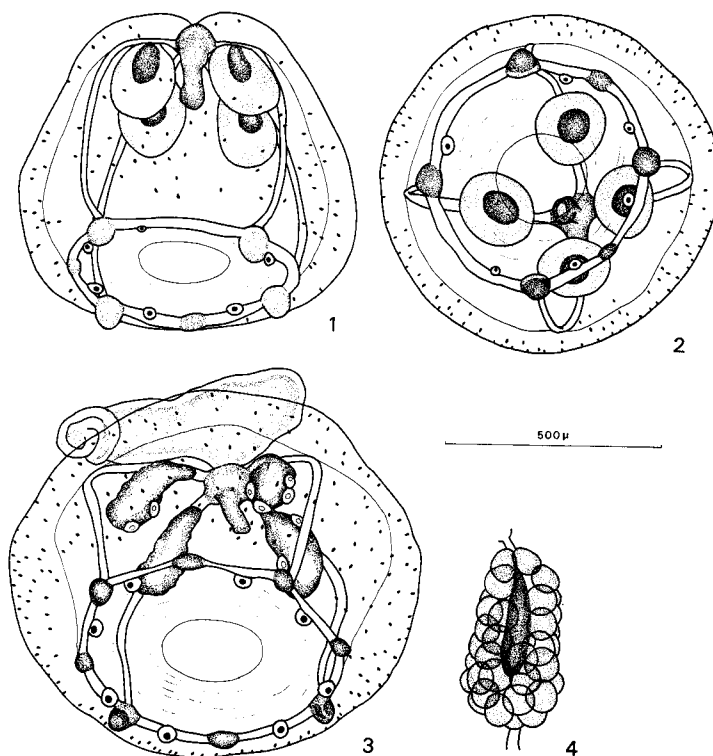


Fig. 5. The newly liberated medusa. 1, 2: male medusa, side and oral view, specimen 8; 3: female medusa with a remnant of polyp, side view, specimen 9; 4: female gonad before discharge, specimen 10.

Length of gonads (GL): ♀, 0.20–0.29–0.44 mm, 0.08; ♂, 0.16–0.23–0.28 mm, 0.04

Maximum width of gonads (GW): ♀, 0.12–0.17–0.24 mm, 0.03; ♂, 0.14–0.17–0.20 mm, 0.02

Width of velum (V): ♀, 0.12–0.16–0.18 mm, 0.01; ♂, 0.12–0.15–0.18 mm, 0.02

Number of statocysts (St): ♀, 8–8.0–8, 0.0; ♂, 4–6.9–8, 1.4

Number of marginal warts, perradial ones plus other ones (Tb): ♀, 4–4.0–4, 0.0 + 4–4.0–4, 0.0; ♂, 4–4.0–4, 0.0 + 0–2.3–4, 1.4

W/H: ♀, 1.16–1.41–1.80, 0.16; ♂, 1.08–1.21–1.43, 0.11

J/H: ♀, 0.10–0.17–0.28, 0.04; ♂, 0.11–0.15–0.17, 0.02

S/W: ♀, 0.10–0.14–0.19, 0.02; ♂, 0.11–0.14–0.15, 0.01

ML/H: ♀, 0.07–0.18–0.25, 0.05; ♂, 0.13–0.16–0.22, 0.03

Some morphological differences were found between female and male medusae. In the male medusa, the gonads are a little shorter (see GL), and the numbers of statocysts and marginal warts are fewer (see St, Tb); furthermore the stomach, marginal warts, and the core of gonads are dark brown in color in male, while they are orange in female. In all the female medusae examined, marginal warts are regularly present on all the perradii and interradii, eight in number, and the marginal warts on interradii are always smaller than those on perradii (Fig. 6, I); whereas in most of the male medusae small marginal warts were absent on some interradii, so four to eight in number (Fig. 6, I-IX). In all the female medusae, on the other hand, eight statocysts are regularly present on adradial, two in a

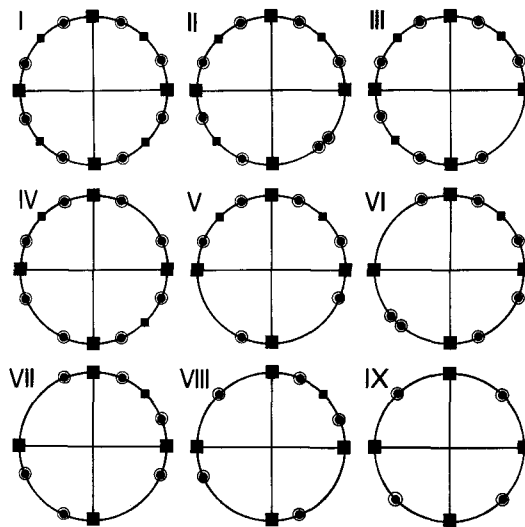


Fig. 6. Schematic illustration of the position of marginal warts (■: large ones, ■: small ones) and statocysts (●), oral view. The number of specimens exhibited each pattern (I-IX) are: I, 16 ♀ + 4 ♂; II-IX: 1 ♂ respectively.

quadrant (Fig. 6, I); whereas in most of the male medusae some adradial statocysts in some quadrants were absent (Fig. 6, III, V-IX), and some statocysts were present on interradii in place of the small marginal warts (Fig. 6, VIII, IX) so four to eight in number, furthermore two statocysts were present near the interradii, standing side by side (Fig. 6, II, VI) and some statocysts were very small (see Fig. 5, 1, 2). The position and number of statocysts are, therefore, greatly variable among male medusae.

It was found that the manubrium was entirely absent in one female medusa which was liberated from its polyp after it was carried back from Shimoda to the laboratory at Sapporo. The measurements of this medusa are as follows, in mm:

W=0.88, H=0.52, J=0.12, S=0.10, GL=0.16, GW=0.12, V=0.16, St=8, Tb=4+4.

The medusae supposed to be of the present species were not found among the plankton samples from Nabeta Bay on 24 and 25th, August, 1977.

Description of Nematocysts

On the polypoid and medusan stages of the present hydroid, the constitution and size (length \times maximum width of undischarged capsules) of nematocysts were examined.

Six polyps picked up from the mussel of 4.4 cm in shell length and two polyps from the mussel of 3.4 cm were squashed and one kind of nematocysts, basitrichous isorhizes (or microbasic mastigophores), of two types (large and small ones) were found in the whole body (Fig. 7, 1, 2). However, only a small number of nematocysts of large type was found in the body parts except for tentacles in four specimens, but they were absent in four specimens in the former mussel; and the tentacles contained only the small type. The size of the nematocysts of polyp was as follows (the number of nematocysts measured are shown in parentheses):

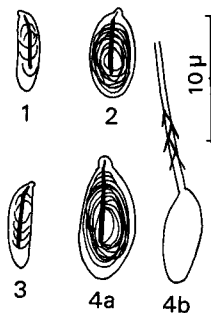


Fig. 7. Nematocysts of polyp (1, 2) and medusa (3, 4).

Small type (Fig. 7, 1): ♀, 6.4–6.9–7.8, 0.35×1.6 – 1.8 – 2.2μ , 0.12, 3 (50); ♂, 7.2–7.7–8.4, 0.38×1.8 – 2.0 – 2.4μ , 0.22, 2 (20)

Large type (Fig. 7, 2): ♀, 7.2–7.7–8.0, 0.42×3.6 – 3.7 – 3.8μ , 0.14, 1 (3); ♂, 8.0–8.5–9.6, 0.92×3.4 – 3.8 – 4.0μ , 0.37, 1 (3)

One female and one male medusa were squashed, and one kind of nematocysts of two types, which are of constitution and size similar to nematocysts in polyp, was found (Fig. 7, 3, 4). Their measurements are as follows:

Small type (Fig. 7, 3): ♀ (on marginal warts), 6.8–7.7–8.8, 0.63×1.8 – 2.2 – 2.6μ , 0.30 (11); ♀ (on manubrium), 5.8–6.6–7.2, 0.40×1.6 – 1.8 – 2.2μ , 0.19 (14); ♂ (on marginal warts and manubrium), 6.6–7.1–8.8, 0.60×1.8 – 1.9 – 2.2μ , 0.14 (20)

Large type on exumbrella (Fig. 7, 4a, 4b): ♀, 8.0–8.6–9.0, 0.36×3.8 – 4.1 – 4.4μ , 0.18 (18); ♂, 8.2–9.2–10.0, 0.58×3.6 – 4.0 – 4.4μ , 0.18 (20)

Remarks

The polyp of the present hydroid resembles all the polyps of commensal hydroids living in several pelecypods so far known excluding the polyp of *Eutima commensalis* associated with some wood-boring pelecypods, whereas the mature medusa of the present hydroid resembles the medusa of *Eugymnanthea inquilina* from Italy in their reduced form and possession of mature gonads when they are liberated from the polyp.

When the present polyp is compared with *Eugy. inquilina* living in *Tapes decussatus* from Naples (described by Palombi, 1935) and in *Mytilus galloprovincialis* from Taranto (described by Cerruti, 1941), their external morphology mostly coincides with each other, although a colony consisting of seven trophozooids and a longer polyp attaining 3.5 mm in length were found in *M. galloprov.*, and the polyp in *Tapes* was shorter and thicker than the present polyp. On the other hand, the present medusa is different from that of *Eugy. inquilina* in Italy living in both the pelecypods mentioned above (cf. Palombi, 1935; Cerruti, 1941; Uchida, 1964) in the presence of reduced manubrium and the less number of statoliths in a statocyst in male and female; furthermore the number of statocysts in the present male medusa is fewer. In the medusa of *Eugy. inquilina* living in *Mytilus* in Italy, three statoliths were usually contained in a statocyst, sometimes two or four, whereas only one statolith was contained in all the present medusae examined. But one statolith was sometimes contained in *Eugy. inquilina* in *Mytilus* in Italy, and the manubrium was absent in one present female medusa; accordingly the morphology of these two medusae is overlapped in a few specimens. It is noteworthy that in the medusa of *Eugy. inquilina* from Italy the number of marginal warts is four in the material found in *Tapes*, while eight in the material found in *Mytilus*, though the medusa with four marginal warts and eight statocysts liberated from the polyp living in *Tapes* was not found in the present material.

Considering the above-mentioned morphological distinction and similarity in the polyp and medusa as well as the isolated localities, the present hydroid is referred to a new subspecies of *Eugymnanthea inquilina* Palombi, 1935. The type specimens are deposited in the Zoological Institute, Faculty of Science, Hokkaido University, Japan.

It should be mentioned here that the intertentacular membraneous web (see Fig. 1, 1) and small type of basitrichous isorhizes (see Fig. 7, 1, 3), which are characteristic of Thecata-Leptomedusae (cf. Kubota, 1978: p. 143), are found in the present commensal hydroid.

Summary

From Japanese waters an unrecorded commensal hydroid associated with a mussel, *Mytilus coruscus*, was found in Nabeta Bay, Shimoda on the Pacific coast of Central Japan, and it is referred to a new subspecies, *Eugymnanthea inquilina* Palombi *japonica* n. subsp., based on several distinguishable characteristics of the medusa. The description of the external morphology of the polyp and medusa and the development of medusa-bud as well as the nematocyst equipment are given.

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